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report entitled "Report to Commission 7 about the work accomplished in the USSR in 1958-1960". Commission 7 is that part of the International Astronomical Union concerned with celestial mechanics. The report was prepared by M. F. Subbotin, director of the Institute of Theoretical Astronomy, Leningrad. Its bibliography contains 46 references. -- C-O-N-F-I-D-E-N-T-I-A-L.

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R E P O R T

to Commission 7 about the work accomplished in the USSR in 1958 - 1960.

No attempt is made either to give a complete bibliography of published papers (especially of those pertaining also to the Commission 4, 17, 20 and 22) or to describe theoretical work in detail.

PROBLEM OF THREE BODIES

At the Institute of Theoretical Astronomy at Leningrad the investigations on the final motion in this problem was continued and some interesting results for the case when the constant of energy is negative were obtained by G.A.Merman [1]. He has obtained also [2] a new general solution of the problem of three bodies in the form of convergent series, quite different from that of Sundman. V.A.Brumberg [3] has studied the relativistic problem of three bodies and has found [4] the corresponding corrections for the motion of the Moon with a completeness not yet attained. Some particular cases of the problem of three bodies related to the study of the Trojan group of minor planets and to the Kabe's hypothesis on their origin were investigated by G.A. Chebotarev and his collaborators [5,6,7,8] . Some cases of temporal capture in the elliptical restricted problem were found by V.F.Proskurin and L.I. Kumianceva [9] .

At Sternberg Astronomical Institute, Moscow University, some special aspects of the restricted problem were considered by late N.D.Moiseiev [10] . B.M.Shchigolev [11] investigated the "second Hill's intermediate orbit" as a possible starting point for the solution of the satellite problem.

The conditions of capture in the restricted problem were considered by V.A.Egorov [12].

APPLICATION OF HIGH - SPEED COMPUTERS

At the Institute of Theoretical Astronomy much attention was paid to the utilization of high-speed computers in planetary and satellite theories. These questions were considered by V.T.Gontkovskaya [13] and N.G.Polozova [14, 15] for the planetary theories, by V.A.Shor [16] for the solution of the restricted three body problem by Hill-Brown method.

PLANETARY THEORY

K.A.Lyakh [17] has proposed a new form of the development of the disturbing function suitable for any value of the mutual inclination and more convenient than the form given by Tisserand.

G.M.Bazhenov [18] has published two methods, based on the Tshebyshev's approximation, for computing the absolute perturbations of a minor planet.

M.S. Jarow-Jarowoi [19] has constructed some new principles of the approximate theory of Ceres, which proved to be in essential agreement with the observation for the years 1801 - 1937.

SATELLITE THEORY

G.N.Duboshin [20, 21, 22] has worked out the principles of a new theory of the motions of the satellites of Saturn. A.I.Rybakov [23, 24, 25] has done some numerical applications of the theory. This theory has been applied also by M.P. Kosachevsky [26, 27] in the investigation of the motion of the satellites of Mars.

The motion of a body with negligible mass under the gravitational attraction of a spheroid was studied in the papers by I.D. Zhongolovitch [28], V.F.Proskurin and Yu. V. Batrakov [29], A.A. Orlov [30], M.S. Jarow-Jarowoi [31], V.V.Beletzky [32, 33] and M.D.Kislin [34].

A method for the improving the orbits of the artificial satellites of the Earth from the observations with approximate moments was worked out by D.K.Kulikov and Yu. V. Batrakov [35]. Some problems of orbit determination of these satellites were considered by Yu. V.Batrakov [36] and T.M. Eneev [37].

Some results from the discussion of the observations of the artificial satellites were published by Yu. V.Batrakov [38] and I.D.Zongolkvitch [39].

L.I.Sedov [40] has given a general survey of the orbits towards the Moon.

G.N.Duboshin [41] has studied the rotational mouvements of the artificial celestial bodies.

MISCELLANEOUS WORK

M.S.Petrowskaja [42] by a generalization of the A. Winter's method has shown that the Hill's series representing the variational orbit are actually convergent for $|m| \leq 0.21$, where

$$m = n_1/(n - n')$$

That improves the previous results : $|m| \leq 1/7$ (Lyapunov, 1896) $|m| \leq 1/12$ (Winter, 1929) and $|m| \leq 0.18$ (Merman, 1952).

The differential correction of nearly parabolic orbits was considered by M.F.Subbotin [43]. He has also drawn attention [44] to a useful modification of the conventional method for the computation of the parabolic orbits.

V.F.Myachin [45] has investigated the accumulation of numerical integration errors with the regard on the random character of rounding errors. His theory confirms qualitatively the well-known result of D.Brouwer that after a sufficiently large number K of steps the error is of the order of $K^{3/2}$. The practical application of this theory was investigated by A.S.Sochilina [46].

REFERENCES

[1] Merman G.A. Bull.Inst.astr.Leningrad,6,687-712,1958.

[2] Merman G.A.Bull.Inst.astr.Leningrad, 6,713-732, 1958.

[3] Brumberg V.A. A.Zh.35, 893-903,1959.

[4] Brumberg V.A. Bull.Inst.astr.Leningrad,6,733-756,1958.

[5] Chebotarev G.A. and Bozhkova A.J. Bull.Inst.astr. Leningrad,7, 186-201,1959.

[6] Chebotarev G.A. and Volkov M.S. Bull.Inst.astr. Leningrad,7, 202-207,1959.

[7] Chebotarev G.A. and Volkov M.S.Bull.Inst.astr. Leningrad, 7, 420- 421,1959.

[8] Chebotarev G.A. and Bozhkova A.J. Bull.Inst.astr. Leningrad, 7, 581-587,1960.

[9] Proskurin V.F. and Ramisnceva L.I.Bull.Inst.astr. Leningrad,7, 287-292,1959.

[10] Moiseiev N.D.Publ.Sternberg astr.Inst.,28,9-24,1960.

[11] Shchigolev B.M. Publ.Sternberg astr.Inst.,28,91-120,1960.

[12] Egorov V.A.Artif.satellites of the Earth,Moscow, 3, 3-12, 1959.

[13] Gontkovskaya V.T. Bull.Inst.astr.Leningrad, 6, 592-629, 1958.

[14] Polozova N.G. Bull.Inst.astr.Leningrad,6,757-768,1958.

[15] Polozova N.G. Bull.Inst.astr.Leningrad, 7, 599-638,1960.

[16] Shor V.A. Bull.Inst.astr.Leningrad, 7, 639-674,1960.

[17] Lyakh, K.A. Bull.Inst.astr.Leningrad, 7, 422-440,1959.

[18] Bazhenov G.M., Bull.Inst.astr.Leningrad,7,43-71,1959.

[19] Jarow-Jarowoi M.S. Publ. Sternberg astr.Inst.,28,25-90, 1960.

[20] Duboshin G.N. Publ.Sternberg astr.Inst.,28,121-148,1960.

[21] Duboshin G.N. Publ.Sternberg astr.Inst.,28,149-160.1960.

[22] Duboshin G.N. Publ.Sternberg astr.Inst, 28, 161-170,1960.

[23] Rybakov A.I.Publ. Sternberg astr.,Inst., 28,171-202,1960.

[24] Rybakov A.I. Publ.Sternberg astr.Inst.,28,203-248,1960.

[25] Rybakov. A.I. Publ.Sternberg astr.Inst.,28,249-275,1960.

[26] Kosachevsky M.P. Publ.Sternberg astr.Inst,28,277-291,1960.

[27] Kosachevsky M.P. Publ.Sternberg astr,Inst., 28,293-304, 1960.

[28] Zongolovitch I.D. Bull.Inst.astr.Leningrad, 7, 521-536, 1960.

[29] Proskurin V.F. and Batrakov Iu.V. Bull.Inst.astr.Leningrad,7, 537-548,1960.

[30] Orlov A.A. Bull.Inst.astr.Leningrad,7, 549-551,1960.

[31.] Jarow-Jarowoi M.S.Bull.Inst.astr.Leningrad,7,552-553, 1960.

[32.] Beletzky V.V.Artif.Satellites of the Earth,Moscow, I, 25-43,1958.

[33.] Beletzky V.V.Artif.Satellites of the Earth,Moscow,3, 13-31,1959.

[34.] Kislin M.D.Artif.Satellites of the Earth,Moscow, 4, 3 - W7, 1960.

[35.] Kulikov, D.K. and Batrakov, Yu.V. Bull.Inst.astr.Leningrad,7, 554-569,1960.

[36.] Batrakov Yu.V. Bull.Inst.astr.Leningrad, 7, 570-578,1960.

[37.] Kneev T.M.Artif.Satellites of the Earth,Moscow, 4, 43-55,1960.

[38.] Batrakov Yu. V, Bull.Inst.astr.Leningrad,7,503-510,1960.

[39.] Zhongolovitch I.D.Bull.of the stations for the observation of the artif.Satellites,Moscow,12,1960

[40.] Sedov L.I.artif.Satellites of the Earth,Moscow, 5,3-15 1960.

[41.] Duboshin G.N.Bull.Inst.astr.Leningrad, 7,511-520,1960.

[42.] Petrowskaja M.S.Bull.Inst.astr.Leningrad, 7,441-465,1959

[43.] Subbotin M.F. Bull.Inst.astr.Leningrad, 7, 407-415,1959.

[44.] Subbotin M.F.Bull.Inst.astr.Leningrad.7.416-419,1959.

[45.] Myachin V.F. Bull.Inst.astr.Leningrad, 7, 257-280,1959.

[46.] Sochilina A.S. Bull.Inst.astr. Leningrad,7, 281-286,1959.

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